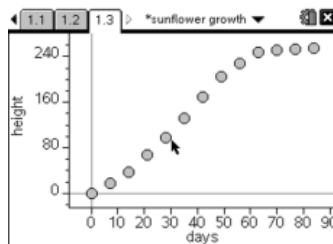


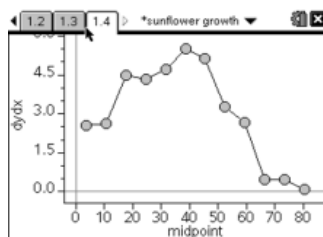
3.1b Derivative as a function - numerically and algebraically

Sunflower growth



	days	height	midpoint
1	0	0.	3.5
2	7	17.93	10.5
3	14	36.36	17.5
4	21	67.76	24.5

	days	height	midpoint	dy/dx
1	0	0.	3.5	2.56143
2	7	17.93	10.5	2.63286
3	14	36.36	17.5	4.48571
4	21	67.76	24.5	4.33429



When is the sunflower growing the fastest?

Sep 9-10:16 PM

3.1 derivatives - algebraic/symbolic
 (derivative)
 what is the slope of $y = x^2 + 2$ at $x = 3$

$$\lim_{h \rightarrow 0} \frac{(3+h)^2 + 2 - 11}{h}$$

$$\lim_{h \rightarrow 0} \frac{9 + 6h + h^2 + 2 - 11}{h}$$

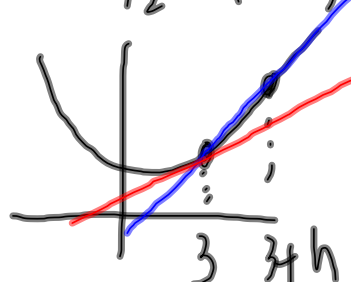
$$\lim_{h \rightarrow 0} \frac{h(6+h)}{h} = 6$$

$$x_1 = 3$$

$$y_1 = 11$$

$$x_2 = 3+h$$

$$y_2 = (3+h)^2 + 2$$



Sep 12-12:11 PM

$$y = x^2 + 2 \quad \text{slope at } x_1 = a$$

$$y_1 = a^2 + 2$$

$$x_2 = a + h$$

$$y_2 = (a+h)^2 + 2$$

$$\lim_{h \rightarrow 0} \frac{(a+h)^2 + 2 - (a^2 + 2)}{h}$$

$$\lim_{h \rightarrow 0} \frac{\cancel{a^2} + 2ah + \cancel{h^2} + 2 - \cancel{a^2} - \cancel{2}}{h}$$

$$\lim_{h \rightarrow 0} \frac{\cancel{h}(2a + h)}{\cancel{h}} = 2a \quad \text{slope formula}$$


Sep 12-12:20 PM

Find the derivative of $y = 1/x$ at $x=1$

Common denominator

$$\lim_{h \rightarrow 0} \frac{\frac{1}{1} \cdot \frac{1}{1+h} - \frac{1}{1} \cdot \frac{1+h}{1+h}}{h}$$

$$\lim_{h \rightarrow 0} \frac{\frac{1 - (1+h)}{1+h}}{h}$$

$$\lim_{h \rightarrow 0} \frac{\frac{-h}{1+h}}{h} = \lim_{h \rightarrow 0} \frac{-h}{1+h} \cdot \frac{1}{h} = -1$$


Sep 9-10:41 PM

$$\lim_{b \rightarrow 1} \frac{\frac{1}{b} - 1 \cdot \frac{1}{b}}{b - 1}$$

Common denominator

$$\lim_{b \rightarrow 1} \frac{\frac{1-b}{b}}{b-1}$$

$$\lim_{b \rightarrow 1} \frac{1-b}{b} \cdot \frac{1}{b-1}$$

$$\lim_{b \rightarrow 1} \frac{-1(b-1)}{b} \cdot \frac{1}{b-1} = -1$$

$$y = \frac{1}{x}$$

$$x_1 = 1$$

$$y_1 = 1$$

$$x_2 = b$$

$$y_2 = \frac{1}{b}$$

Sep 12-12:34 PM

Find the derivative of $y = \sqrt{x+2}$ at $x=7$

Conjugate

$$\lim_{b \rightarrow 7} \frac{(\sqrt{b+2} - 3)(\sqrt{b+2} + 3)}{(b-7)(\sqrt{b+2} + 3)}$$

$$\lim_{b \rightarrow 7} \frac{b+2-9}{(b-7)(\sqrt{b+2} + 3)} = \frac{1}{6}$$

$$x_1 = 7$$

$$y_1 = 3$$

$$x_2 = b$$

$$y_2 = \sqrt{b+2}$$

Sep 10-11:27 AM

One-sided derivatives

Show that the following function has a left hand and a right hand derivative at $x=0$, but no derivative there.

$$f(x) = \begin{cases} x^2 & x \leq 0 \\ 2x & x > 0 \end{cases}$$

right der

$$x_1 = 0 \quad \lim_{h \rightarrow 0} \frac{2h - 0}{h} = 2$$

$$y_1 = 0$$

$$x_2 = 0+h$$

$$y_2 = 2(0+h) = 2h$$

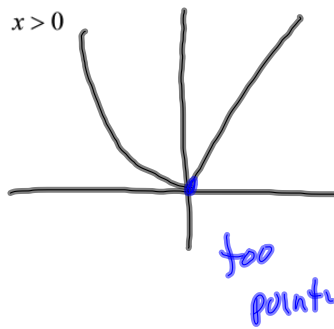
left

$$x_1 = 0 \quad \lim_{h \rightarrow 0} \frac{h^2 - 0}{h} = 0$$

$$y_1 = 0$$

$$x_2 = 0+h$$

$$y_2 = (0+h)^2 = h^2$$



left \neq right

Sep 10-11:33 AM